Teaming Up Humans with Autonomous Synthetic Characters

Rui Prada [a]
[a] *IST-Technical University of Lisbon and INESC-ID*
Avenida Prof. Cavaco Silva - Taguspark
2744-016 Porto Salvo, Portugal
E-mail: {rui,prada}@gaips.inesc-id.pt

Autonomous synthetic characters have the potential to promote the social engagement of users in virtual environments, thus enhancing their interaction experience. This effect is supported by the interactions between users and synthetic characters perform together, which are often in group scenarios. However, for these group interactions to be successful, it is not enough to assure that the characters behave in a coherent manner from an individual perspective, but it is also necessary that they exhibit behaviours that are coherent with the group's composition, context and structure. Therefore, we have developed a model to support group dynamics of autonomous synthetic characters (SGD model), inspired in theories developed in human social psychological sciences, that define the knowledge that each individual should build about the others and the group, and how this knowledge drives their interactions. This model was used to drive the behaviour of characters in a collaborative computer game that was used in an experiment that showed that the SGD Model had a positive effect on the users' social engagement, namely on their trust and identification with the group.

Keywords: autonomous synthetic characters, group interactions, cognitive models, human-machine interaction

1. Introduction

The creation of autonomous synthetic characters has been widely studied in the past years. This interest is grounded on the evidence that the use of such characters can improve the interaction of users with virtual environments [4]. For this reason, autonomous synthetic characters have been used in many different domains such as entertainment [8], business [6] and education [12].

Furthermore, there is evidence that in order to have this sucessful effect, autonomous synthetic characters have to be believable. Thus, they should have the ability to create the "illusion of life" in the eyes of viewers and lead them to the suspension of disbelief [5]. In other words, autonomous synthetic characters must be coherent with the users' expectations.

One particular scenario that has not been extensively explored concerns the interaction of autonomous synthetic characters and users in collaborative groups. However, this type of scenario is becoming more and more common as collaborative virtual environments are now populated with synthetic characters and users at the same time, all interacting, collaborating or competing with each other. Examples of this can be found in Internet communities, such as *Second Life*[2] and *ActiveWorlds*[1] and in Role-playing Computer Games, such as, "Neverwinter Nights 2"[7].

The work presented here addresses the problem of creating groups of autonomous synthetic characters and promoting the collaboration of such groups with users, while making the emergent interactions and collaboration, natural and believable. To achieve this, we grounded our developments on the hypothesis that the interactions and dynamics of the synthetic group should resemble the collaboration and interactions that emerge in human groups. Doing so, we believed that the synthetic group would become more believable which would consequently improve the interaction experience of a user that actively participates in the group.

2. SGD Model

A model to support the behaviour of a cognitive synthetic agent in a group scenario (Synthetic

AI Communications
ISSN 0921-7126, IOS Press.

Group Dynamics Model - SGD Model) [1] was designed and inspired by several theories of human group dynamics developed in socio-psychological studies, such as McGrath's theory of groups [11], Bales' IPA model [3], French and Raven's theory of social power [9] and Heider's balance theory [10]. This model defines the group process as a set of interactions that occur between the several agents, which are grounded on the knowledge that each agent builds regarding the group, the other members and the social context.

One important facet of this knowledge concerns the social relations that the members establish with each other and that constitute the main structuring mechanism of the group. Each member of the group should model two different kinds of social interactions: *social attraction* relations, which are related to the liking and disliking attitudes, and *social influence* relations, which are related to the social power.

In addition, the SGD Model defines some rules for the group dynamics that determine, on one hand, the conditions for the occurrence of the interactions and, on the other hand, the effects that such interactions have on the group. These dynamics are based on a categorization of the several kinds of interactions that occur in the group that divide the interactions into two main classes: the socio-emotional interactions and the instrumental interactions (related to the task).

3. Results

The SGD Model was implemented in the behaviour of the synthetic characters that are part of a game, the *Perfect Circle*, that engages players in a group of four synthetic characters. These characters play the role of adventurers that wander in a fantasy world and face several challenges in their quest for a sacred item. The group must interact and collaborate in order to overcome each consecutive challenge. Thus, they can propose actions, manipulate objects, express their opinions about the current proposals and actions, and can encourage or discourage the other members.

The *Perfect Circle* game was developed with the main purpose of evaluating the SGD Model. Therefore, it was used in an experiment conducted in our university, in order to evaluate the effects of the SGD Model on the interaction experience of a user with a synthetic group. This experiment was run with three different control conditions that, besides controlling the use of the SDG Model, also controlled the initial cohesion of the group.

The users' interaction experience was measured in terms of four different variables: their trust in the group, their identification with the group, their sense of social presence in the virtual environment and their general satisfaction with the game.

The experiment's final results show that the use of the SGD Model to drive the behaviour of the synthetic characters in the group had a positive effect on the users' interactions, specially on the users' trust and identification with the synthetic group. These results confirm the hypothesis that grounded this research and, therefore, we can conclude that if the interactions in a group of synthetic characters follow similar dynamics as the interactions in human groups then the users' interaction experience is in fact improved.

4. Conclusions and Future Work

In this paper it is argued that group believability of synthetic characters is important when, within the group, there are autonomous characters and users interacting with each other. To achieve such group believability, a model inspired by theories of group dynamics developed in human social psychological sciences was proposed, based on a categorization of the different types of interactions that may occur in a group. The model was implemented in the behaviour of several synthetic characters that collaborate with the user within the context of a computer game. This game was used in an evaluation experiment, which showed that the model had a positive effect on the users' interaction experience.

Furthermore, the model presented used a simplified view of the group process. Thus, there are aspects of the group dynamics that could be further explored, for example, the dynamics of the group regarding its composition, inter-group relations and members' level of individualism.

[1] For more detail regarding the SGD Model check *http://gaips.inesc-id.pt/gaips/pub_en.htm* where you can find Rui Prada's PhD thesis.

5. Acknowledgments

I would like to thank my supervisor Prof. Ana Paiva for all the supoort and for all the oportunities she gave me while I was developing the work here presented.

References

[1] The activeworlds. *(online) http://www.activeworlds.com*, last access on May 2007.

[2] Second life. *(online) http://secondlife.com/*, last access on May 2007.

[3] R. F. Bales. *Interaction Process Analysis*. The University of Chicago Press, Chicago, 1950.

[4] J. Bates. Virtual reality, art and entertainment. *Presence: teleoperators and Virtual Environments*, 1992.

[5] J. Bates. The role of emotions in believable characters. *Communications of the ACM*, 37(7):122–125, 1994.

[6] T. Bickmore and J. Cassell. Relational agents: a model and implementation of building user trust. In *Proceedings of the Conference on Human Factors in Computing Systems - CHI'2001*, Seattle, USA, 2001. ACM Press.

[7] Bioware. Neverwinter nights 2. *(online) http://nwn.bioware.com/*, 2006.

[8] B. Blumberg. (void*): A cast of characters. In *Visual proceedings of the conference on SIGGRAPH 99*, page 169. ACM Press, 1999.

[9] J. R. P. French and B. H. Raven. *Group Dynamics: Research and Theory*, chapter Bases of Social Power. Harper and Row, New York, 1968.

[10] F. Heider. Attitudes and cognitive organization. *Journal of Psychology*, (21):107–112, 1946.

[11] J. E. McGrath. *Groups: Interaction and Performance*. Prentice Hall, Englewood Cliffs, New Jersey, 1984.

[12] J. Rickel and W. L. Johnson. Virtual humans for team training in virtual reality. In *Proceedings of the Ninth International Conference on AI in Education*, pages 578–585, 1999.